CITY OF TUCSON WATER DEPARTMENT

Annual

Drought Monitoring Report

April 30, 2009

CITY OF TUCSON WATER DEPARTMENT
ANNUAL DROUGHT MONITORING REPORT
April, 2009

INDEX

ILLUSTRATIONS

Acknowledgements

Cover art: Tucson Water Graphic Artist Anna-Cota Robles photographed the drought-tolerant vegetation recently planted at Tucson Water's La Entrada office building.

Report staff: Tom Arnold, Ries Lindley, Karen LaMartina, Linda Smith

MEMORANDUM

DATE: May 4, 2009

TO: Mike Letcher
City Manager

FROM: Jeff B. Biggs
Tucson Water Director

SUBJECT: Continuation of Stage 1 Drought Response for Tucson Water Service Area

Background

Tucson Water staff developed a Drought Preparedness and Response Plan (Plan) in 2006 to comply with state legislation passed during the 2005 legislative session. Mayor and Council approved the Plan in November 2006 and it was then submitted to the Arizona Department of Water Resources (ADWR) as required by A.R.S. §45-342. Mayor and Council subsequently passed an implementation ordinance (No. 10380) in early 2007 to provide enforcement authority for the Plan.

The Plan recognizes that drought impacts do not occur suddenly or without warning and acknowledges that with proper planning and review it is unlikely the community will find itself in an emergency situation caused solely by drought. To ensure this, the Plan calls for annual reporting on the potential impacts of local or regional drought on the Utility's water resources and system characteristics along with a departmental recommendation regarding the appropriate drought response stage to ensure system reliability. The attached drought monitoring report summarizes the results of Tucson Water's procedures to review both regional and local system indicators of potential impacts from drought on the Utility's service area. For the third consecutive year since the Plan was adopted the Utility's recommendation is continuation of the response measures outlined in the Plan for a Stage 1 Drought Response.

Recommendation to Continue Stage 1 Drought Response; Drought Response Indicators

ADWR's guidance document for drought response plan development stresses the statutory requirement for drought response indicators to be directly tied to a water provider's water resource availability. The guidance document also addresses development of indicators for infrastructure reliability based on specific system characteristics. For Tucson Water, water resource availability requires review of both regional (Colorado River) and local conditions that may impact supplies, whereas evaluation of infrastructure reliability primarily requires review of the potable and reclaimed water distribution systems (local system indicators).

Tucson Water's regional indicators include severe or sustained drought on the Colorado River watershed, up to and including declared shortages on the river, and a drought status above normal for the Santa Cruz Watershed as determined by the Arizona Drought Monitoring report issued monthly by the Arizona Drought Preparedness Monitoring Technical Committee overseen by ADWR staff.

Snowmelt from the Colorado River watershed provides runoff into Lakes Powell and Mead, the reservoirs most critical to Arizona's Central Arizona Project (CAP) deliveries. Much of the Colorado River basin snowpack remained 80 to 120 percent of normal as of March, although the watershed remains in a 10-year drought. Combined Powell and Mead reservoir storage is higher than it was at the same time last year. Based on these factors, the U.S. Bureau of Reclamation declared a 'normal' (no shortage) water year for the period October 1, 2008 through September 30, 2009.

Closer to home, winter storms produced slight improvements to Arizona drought conditions in the Santa Cruz Watershed (which serves Tucson), resulting in a long-term prediction of "abnormally dry," the same long-term classification as last year.

Tucson Water's local system drought impact indicators include measures of aquifer storage, potable and reclaimed water production capability (i.e.: water supplies and the ability to deliver them where needed), and gallons per capita per day (GPCD) use. All local system indicators have shown improvements from the 2008 report with the exception of reclaimed production capacity, which is slightly less than it was a year ago. Customer demand, or GPCD, continues to drop - currently reflecting 140 GPCD compared to the 151 GPCD reported in the 2008 report. While GPCD is not a "drought indicator" per se, monitoring GPCD allows the Utility to better assess whether drought response measures previously implemented are having the desired affect. Tucson Water's declining GPCD in the face of long-term drought indicates both the responsiveness and general drought awareness of our customers.

Based on the 2009 monitoring report, Tucson Water recommends that a Stage 1 Drought Response be continued for the Tucson Water Service Area. The focus of a Stage 1 response from a community perspective is to communicate information about drought to our customers and emphasize water use efficiency. Additional measures may include voluntary self-audit programs for commercial, multi-family, and industrial users. City departments also are encouraged to continue improving the management of their water use from an efficiency perspective.

CC: Dennis Rule, Fernando Molina, Karen LaMartina – Tucson Water

Attachment: Annual Drought Monitoring Report - 2009

CITY OF TUCSON WATER DEPARTMENT
ANNUAL DROUGHT MONITORING REPORT
April, 2009

Background

Tucson Water submitted the City of Tucson Water Department's Drought Preparedness and Response Plan (http://www.ci.tucson.az.us/water/drought-intro.htm) to the Arizona Department of Water Resources (ADWR) in December 2006 in accordance with state legislation passed during the 2005 legislative session (see A.R.S § 45-342). Mayor and Council approved the Plan on November 28, 2006 and an implementation ordinance (No. 10380) providing enforcement authority was approved on March 20, 2007.

The Plan establishes four drought response stages, outlines an action plan for responding to potential drought-related impacts on Tucson Water's system and water supplies, and addresses the issue of emergency supplies. The Plan demonstrates the long-term financial investment the community has made in securing and implementing use of renewable water resources such as Colorado River water via the Central Arizona Project and treated effluent through the reclaimed water system. That investment, coupled with on-going system evaluation and water resource planning, provides considerable reliability to withstand the impacts of sustained drought on Tucson Water's supplies and system and is recognized in the Plan's drought response stages.

The annual drought monitoring report is an outcome of procedures Tucson Water staff implements to determine the impacts of the long-term drought on the Utility's water resources and distribution system. Supplement A to the drought response plan (*System Assessment Team Implementation Guide*, November 2007) explains these procedures in greater detail.

The Plan and the Implementation Guide discuss the statutory requirement for tying water system characteristics and water resource availability to multi-staged drought response. Tucson Water's regional indicators are severe or sustained drought on the Colorado River watershed, including declared shortages on the Colorado River; and a drought status above normal for the Santa Cruz Watershed, which includes Tucson. Local indicators are measures of aquifer storage, potable and reclaimed water production capacity, and gallons per capita per day use by Tucson Water customers.

This report provides the outcome of staff's assessment of these indicators, followed by a drought response stage recommendation for 2009. In addition, this year's report includes a brief discussion of drought as an outcome of climate change and also provides some additional planning information related to a report recently received from ADWR related to small water providers adjacent to Tucson Water's service area.

Drought in the Western United States

The Arizona drought preparedness plan defines drought as a *sustained, natural reduction in precipitation that results in negative impacts to the environment and human activities.* Arizona, like much of the western and southern United States, remains in a decade-long drought. These regions rely on snowmelt to replenish their associated watersheds and are either experiencing less snowpack overall or a quick melt that doesn't adequately replenish reservoirs and rivers.

For example, reduced snowpack in the northern part of California coupled with an endangered species issue impacting transfer of water to southern California, resulted in the California governor declaring a statewide emergency in February 2009 largely related to the prolonged drought. Similarly, decision-makers in Southern Nevada, which gets almost 90 percent of its water from the Colorado River, have become increasingly concerned about declining reservoir levels in Lake Mead and continue to secure supplies for mega-centers like Las Vegas that until the recession were experiencing record growth. With the economic downturn the financial resources needed to secure those supplies has also been decreased. While neither of these situations is fully attributable to drought, long-term drought does play a substantial role in policy and operational decisions impacting water resources in both states.

In recent years scientists have made a clear link between drought and global warming (climate change) and have speculated as to whether drought events will become more of the "normal" weather patterns in southwestern regions of the United States. But, as Tucson Water's Plan states, drought is not a rapid onset condition, and each region reacts differently according to the condition of its watershed and water supply, delivery system and backup supplies. For example, while Arizona is certainly not 'out of the woods' when it comes to drought, it is located in a different watershed from California and is not directly impacted by the issues at play there. Nonetheless, continual monitoring and planning to meet future demand is required.

Drought, its Relationship to Climate Change and the City's Efforts to Monitor Climate Change

Tucson Water's water resource and system planning, including drought response planning, is a dynamic process. Successful planning requires periodic updates of any written plans. In the case of the Drought Preparedness and Response Plan, Arizona statute requires an updated plan every five years. However, between required updates, changes must be made as well to reflect gained knowledge and experience and to address changing conditions. With time and research providing a better understanding of climate change, it has now become clear that drought and climate change too must be considered in any long-term planning effort.

The Association of Metropolitan Water Agencies (AMWA) in its December 2007 report, *Implications for Climate Change for Urban Water Utilities,* provides insight into climate change impacts on the United States. According to the report, in the southwest region

there will likely be less surface water available from runoff and less water available for recharge. Water demands will likely increase. And, although there will be less precipitation overall, individual rainfall events will likely be more intense, resulting in increased sediment transport and increased turbidity.

These physical impacts to water supply will, by themselves, create planning challenges. In addition to these challenges, planners will also need to take into account impacts on socioeconomic systems. AMWA's report states, "Regardless of whether the water and wastewater utilities are separate organizations or combined as a single organization, their fates are always closely tied together by the water bill because affordability is indifferent to organizational distinctions." Climate change could drive spending, spending will have impacts on people, and all water utilities will be affected.

Further, climate change will affect the environment. The increased sedimentation and turbidity from more intense flood events will cause reservoirs to become shallower, warmer, and more eutrophic. These unwanted results may require planning for invasive species management (e.g., quagga mussels), protecting threatened and endangered species, and assuring water quality. These environmental concerns will also have impacts on people, and their quality of life.

Drought response planning is a way of formally preparing for climate change, so it is not really possible to plan for drought without taking climate change into consideration. What is implied now in the words "climate change" is consideration of the rate, amplitude, and socioeconomic impacts of such change. Although climate change is normal, new understanding of its current implications suggests it may be more severe in the future. These implications have been considered in recent planning, and will become formalized in updates to Tucson Water's *Drought Preparedness and Response Plan* in the future.

Local Activities

Starting this year, the City's Office of Conservation and Sustainable Development (OSCD) will be working with a 26-member climate change committee to develop a set of recommendations for reducing local greenhouse gas emissions and for adapting to the climatic and other resource changes that will occur as a result of past world-wide greenhouse gas emissions. As part of this planning effort, the City will consider how climate change may increase the per capita use of water, how this increased use will be linked to preserving human health and welfare, the need to shift water for purposes of meeting local food and energy needs, and how potential future shortages in water availability can be handled to reduce social, economic, and environmental consequences for our community.

In addition to the City's climate change committee, there is also a study currently ongoing titled, "Assessment of Climate Impacts on the Surface Water Resources for Central Arizona." The main participants are the City of Phoenix Water Department, Salt River Project, Central Arizona Project, the Bureau of Reclamation, City of Scottsdale, Arizona State University, and University of Arizona. Tucson Water technical staff is participating

at the invitation of the City of Phoenix Water Department. Phoenix's concerns relate to the Colorado River Watershed (Central Arizona Project) and the Salt River Watershed (Salt River Project). Tucson is primarily interested in the former.

Another important resource that can be tapped for information on drought and climate change is experts at Arizona State University and the University of Arizona who are looking to "downscale" selected global climate/circulation models. This modeling will provide a better understanding of what might occur in the Southwest and Arizona and help assess the range of uncertainty in such modeling forecasts. Results from this and other efforts, such as those of the City's climate change committee, will be available for use by water providers, university researchers, and others to improve drought planning and preparedness. Coordination among the various participants will be important.

Status of Regional Indicators

- **Colorado River Status**

  The Colorado River water delivered through the Central Arizona Project is a vital resource to the Tucson Water service area. More than half of Tucson Water's annual water demand is met through this renewable surface water resource, and Colorado River water will provide even more of the water supply to meet this demand in future years. Snow conditions from the Colorado River watershed provide runoff into Lakes Powell and Mead, the reservoirs most critical to Arizona Colorado River deliveries. As of March 2009, much the Upper River Basin snow-water equivalent remained 80 to 120 percent of normal. (See Figure A-1).

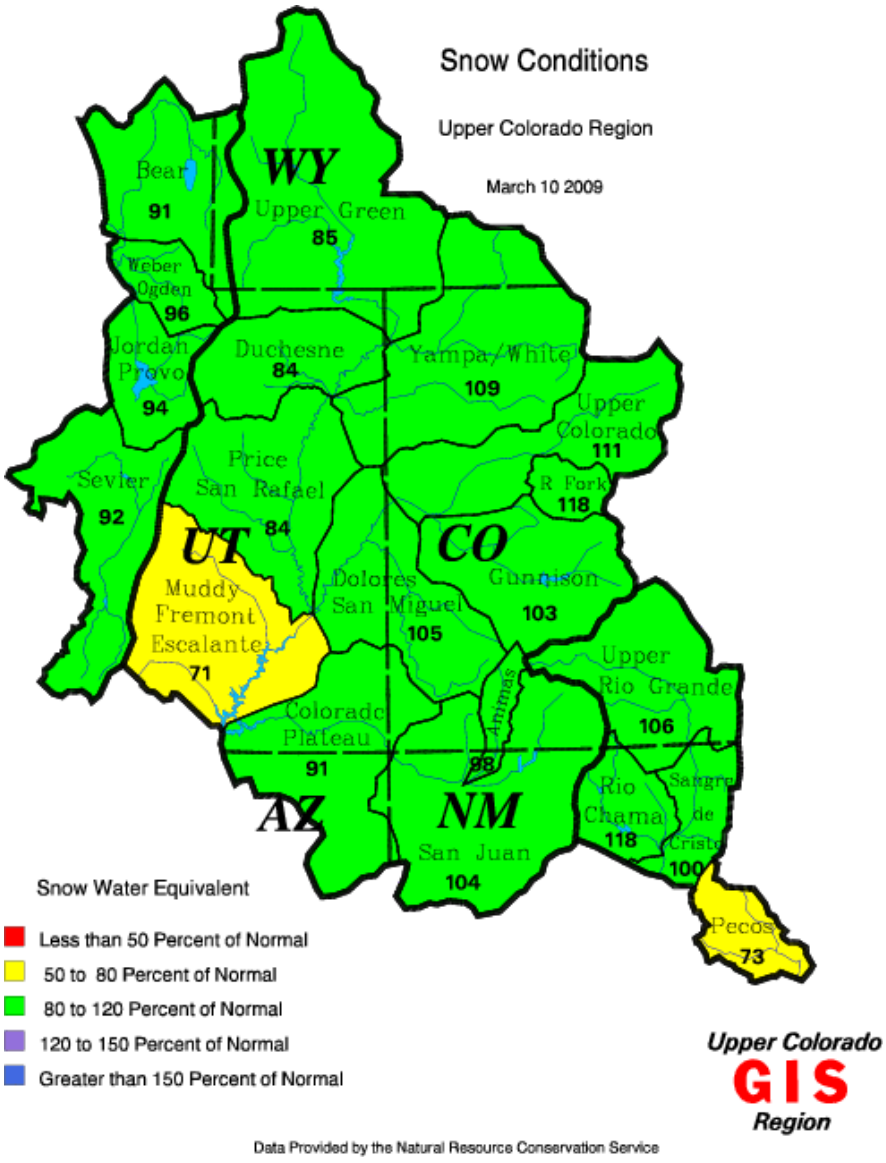

Figure A-1: Snow Conditions – Upper Colorado Region, March 10, 2009. (U.S. Bureau of Reclamation from data provided by the Natural Resource Conservation Service).

The National Water and Climate Center reports that combined Powell and Mead reservoir storage is 1.5 million acre-feet higher than it was at this same time last year, even though storage in both reservoirs was down 253,000 acre-feet in February. The Secretary of the Interior, through the U.S. Bureau of Reclamation, annually determines the condition of the Colorado River for the coming 'water year' (from October to September) as surplus, normal, or average. In its 2009 Annual Operating Plan the Bureau did not declare a shortage on the river for the 2008 water year (2009 Annual Operation Plan, U.S. Bureau of Reclamation, December 2008).

In only the second time since year 2000 Lake Powell's water level rose almost 30 feet during the water year, which is equal to about 2.6 million acre-feet (*Southwest Climate Outlook*, October 2008). See also Figure A-2 (Source: U.S. Bureau of Reclamation web site, March 2009).

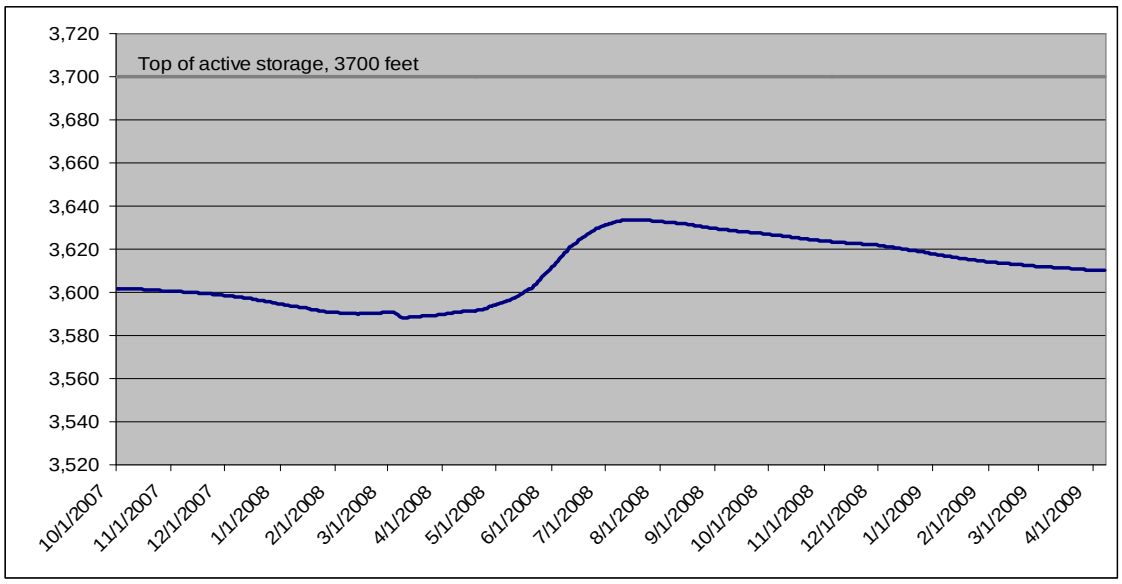

Figure A-2: Lake Powell surface water elevations.

- **Santa Cruz Watershed Drought Status**

Another regional indicator Tucson Water staff utilize is the drought status for the Santa Cruz watershed, as determined by ADWR's Drought Monitoring Technical Committee. This information appears in the Committee's monthly Drought Monitoring Report on the ADWR website as well as the *Southwest Climate Outlook* newsletter produced by CLIMAS (Climate Assessment for the Southwest Project) at the University of Arizona. As of March 2009 improvements to Arizona drought conditions were reported due to winter storms, with much of the state showing improvement in its drought classification.

The short-term improvement in drought level may be seen by comparing the short-term and long-term maps in Figure A-3 below. Despite these improvements, short- term (precipitation only in the past 12 months) and long- term (streamflow and precipitation records over the past four years) predictions for the Santa Cruz Watershed specific to Pima County is still "abnormally dry."

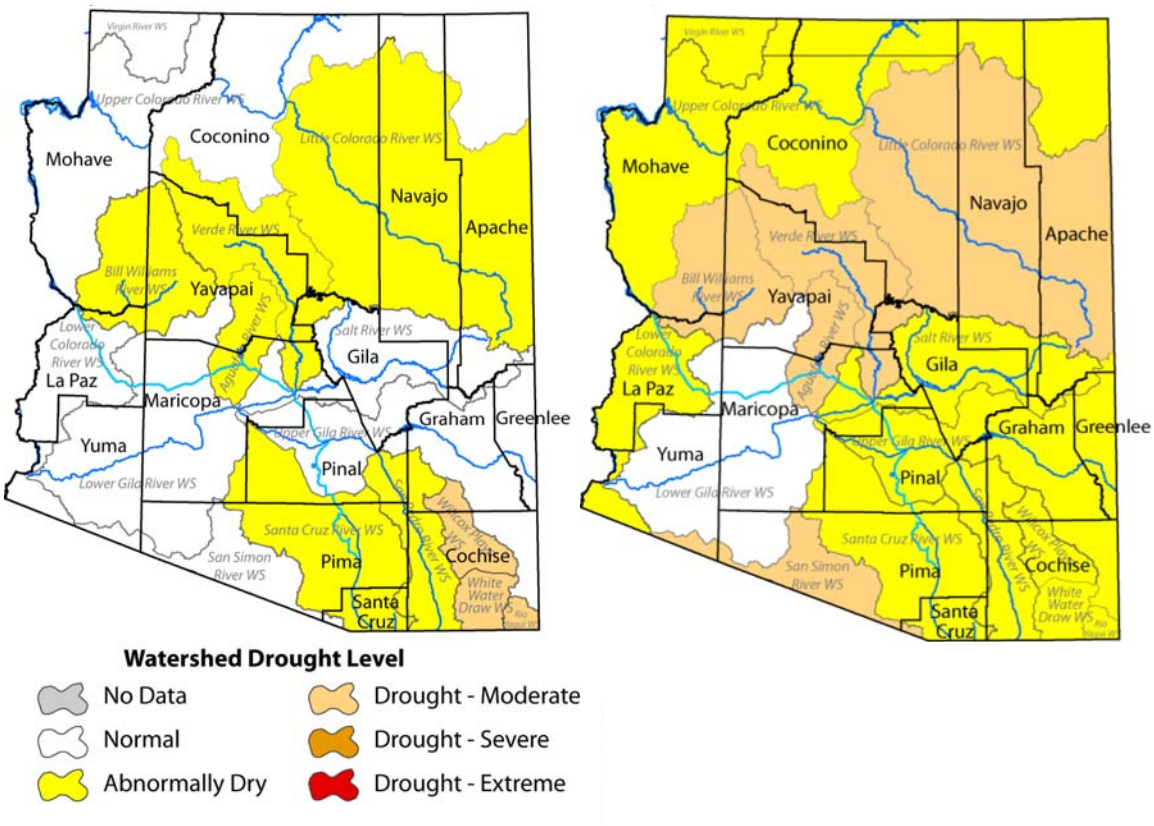

Figure A-3: Arizona short-term drought level (left) for February 2009 and long-term level (right) as of January 2009. (Source: ADWR Drought Monitoring Technical Committee, as published in the Climate Assessment for the Southwest, *Southwest Climate Outlook* – March 2009).

Status of Local System Indicators

- **Aquifer Storage Index**

The Aquifer Storage Index (ASI) captures the net effects on water table levels from pumping and from natural and artificial recharge. It is a measure of the change in water storage volume relative to a base year of 2000. Tucson Water's production wells are grouped into 11 regions of hydrologic similarity for this calculation. Each region is represented by one average water level, simplifying water level change comparison. See Figure A-4.

2009 Aquifer Storage Index: The Aquifer Storage Index continues its dramatic improvement since 2003. This is due to continued increases in production from CAVSARP and falling demand for potable water, resulting in less use of mined groundwater as a percent of all potable demand.

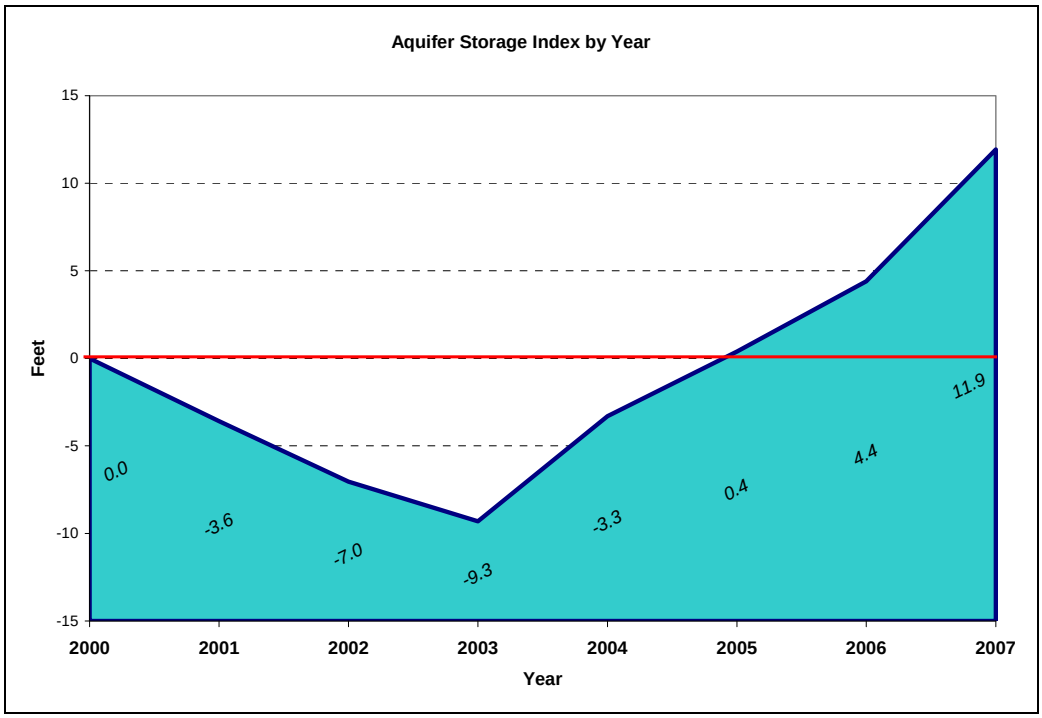

Figure A-4: Aquifer Storage Index.

- **Potable Production Capacity Index (PPCI):**

The Potable Production Capacity Index (PPCI) is a ratio of potable production capacity available for the coming year (in millions of gallons per day, mgd) divided by the predicted maximum 30-day demand period for the upcoming year (in mgd). Data from Tucson Water's Well Status Report is the primary information source for the PPCI. An index score of "1.1" or higher is considered good; lower than 1 indicates some degree of system stress.

As a result of continued improvements in potable production capacity combined with falling demand during the peak 30 day demand period, the PPCI has improved substantially from 1.14 in the 2008 report to 1.24 for 2009.

Production Capacity = 184.2 MGD
Forecasted Max 30-Day Demand (2008) = 148.28 MGDPPCI =184.2 ÷ 148.28 = 1.24

- **Gallons Per Capita Per day (GPCD):**

Gallons Per Capita per Day is the total potable water produced by Tucson Water for the previous year divided by the estimated service area population for that year. The 2008 report for GPCD is 140.4, down from 150.7 reported in 2007. See Figure A-5.

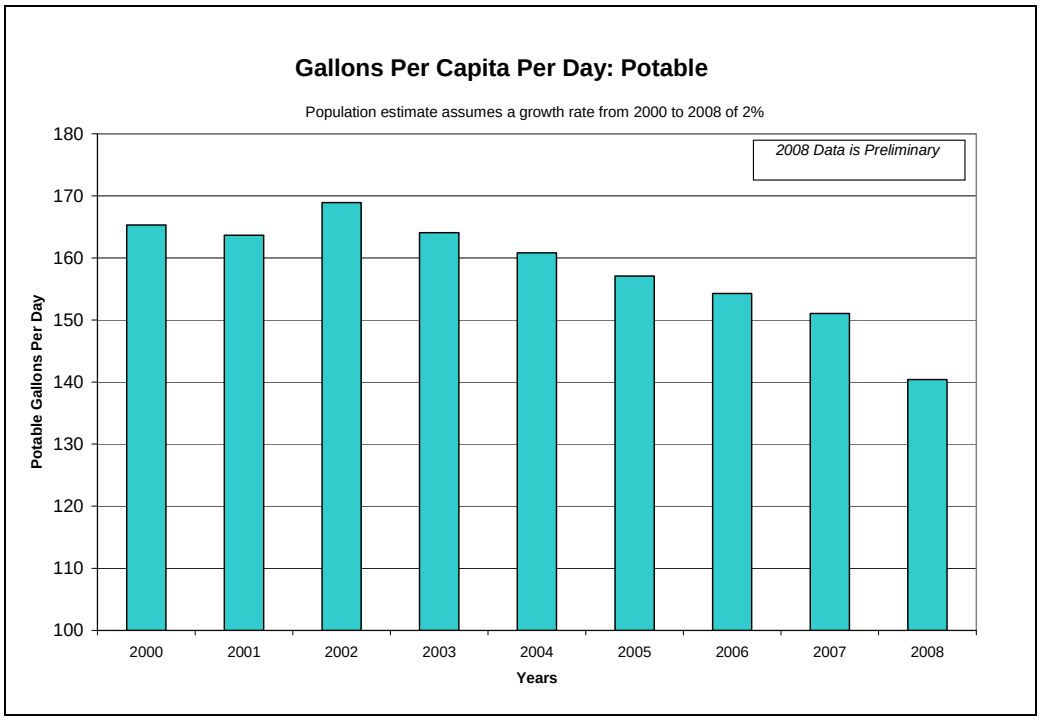

Figure A-5: Gallons Per Capita per Day (GPCD).

The source for potable water produced is the annual pumpage report prepared every March by Tucson Water staff for Arizona Department of Water Resources (ADWR). Service area population is calculated by increasing the 2000 population by 2 percent per year. ADWR has accepted this method of population estimate until such time as a more accurate method is developed; Utility staff is currently working with ADWR to develop another method.

- **Reclaimed Production Capacity Index (RPCI):**

The RPCI is the ratio of maximum reclaimed water production capacity for the upcoming year to the peak day forecast for reclaimed water demand for the upcoming year. An index score of "1.1" or higher is considered good.

The RPCI calculation and outcome appears below:

Production = (28mgd (Reclaimed Plant) + 3.7 mgd (EW7) + 1.8 mgd (Randolph Plant)) = 33.5mgd
Demand = 31.8 MGD
RPCI = 1.05 (slightly down from 1.09 in the 2008 report; this score indicates 'adequate production capacity' but with no extra freeboard.)

Staff Recommendation on Drought Response Stage

Tucson Water's Drought Response Plan includes four response stages, with Stage 1 Response being the mildest (public education) and Stage 4 being the most stringent (water use restrictions) in terms of drought response measures.

A Stage 1 Drought Response was declared for the Tucson Water Service Area in April 2007 based on the indicators adopted in the drought response plan. A Stage 1 Drought Response was continued in April 2008 based on staff's assessment of regional and local indicators and water system indexes.

Based on the annual review of regional and local system indicators, staff recommends that a Stage 1 Drought Response be continued in the Tucson Water service area in 2009.

The focus of Stage 1 response measures is to increase community awareness of drought and promote water use efficiency. Additional measures may include voluntary self-audit programs for commercial, multi-family, and industrial users. Tucson city departments initiated plans for a self-audit program in 2007 to determine if further efficiency measures could be undertaken in day-to-day operations in city owned or operated facilities. That effort is on-going at this time but has met with delays related to budget issues and loss of staff due to retirements.

From a water system standpoint a Stage 1 response means changes in system operations or maintenance programs to reduce water loss. For example, Tucson Water continues its water loss control program, which includes a meter replacement and leak detection component.

REPORT ADDENDUM

Preparing for the Unexpected

Planning documents are not intended to simply provide a rigid framework for executing a set response to predicted futures. Rather, plans are intended to open avenues for consideration of the unexpected. In that regard, drought planning staff considers issues outside the framework of the plan in an effort to avoid the unexpected.

The inception of the Governor's Drought Task force in 2003 resulted in legislation and requirements for drought preparedness at all levels, from the smallest water system to the state as a whole. The Arizona Department of Water Resources administers drought preparedness requirements and tracks those entities that have not complied with drought response requirements. ADWR is required to inform water providers in each Active Management Area of any adjacent or near-by providers that have not filed either a drought plan or an annual report as required by statute. To comply with this requirement, ADWR provided the City of Tucson with a list of water providers not in compliance with the statute.

Tucson Water staff searched through the list for water providers adjacent to the Tucson Water service area that could potentially request assistance from Tucson Water in the event of drought-related supply shortfall. Figure A-6 shows those water providers within a 1,000 foot radius of the Tucson Water obligated service area that do not already receive service, including stand-by, from the Utility. Although some of these small water providers are close to the obligated service area, some of them are more than a half mile from suitable mains for hookup, and some are effectively blocked from the possibility of connections by difficult right of way issues.

While these providers may never request assistance from Tucson Water, if drought continues long enough, or if drought impacts become severe enough, Tucson Water will need to be thoroughly aware of the issues and planning of its neighboring providers and their plans.

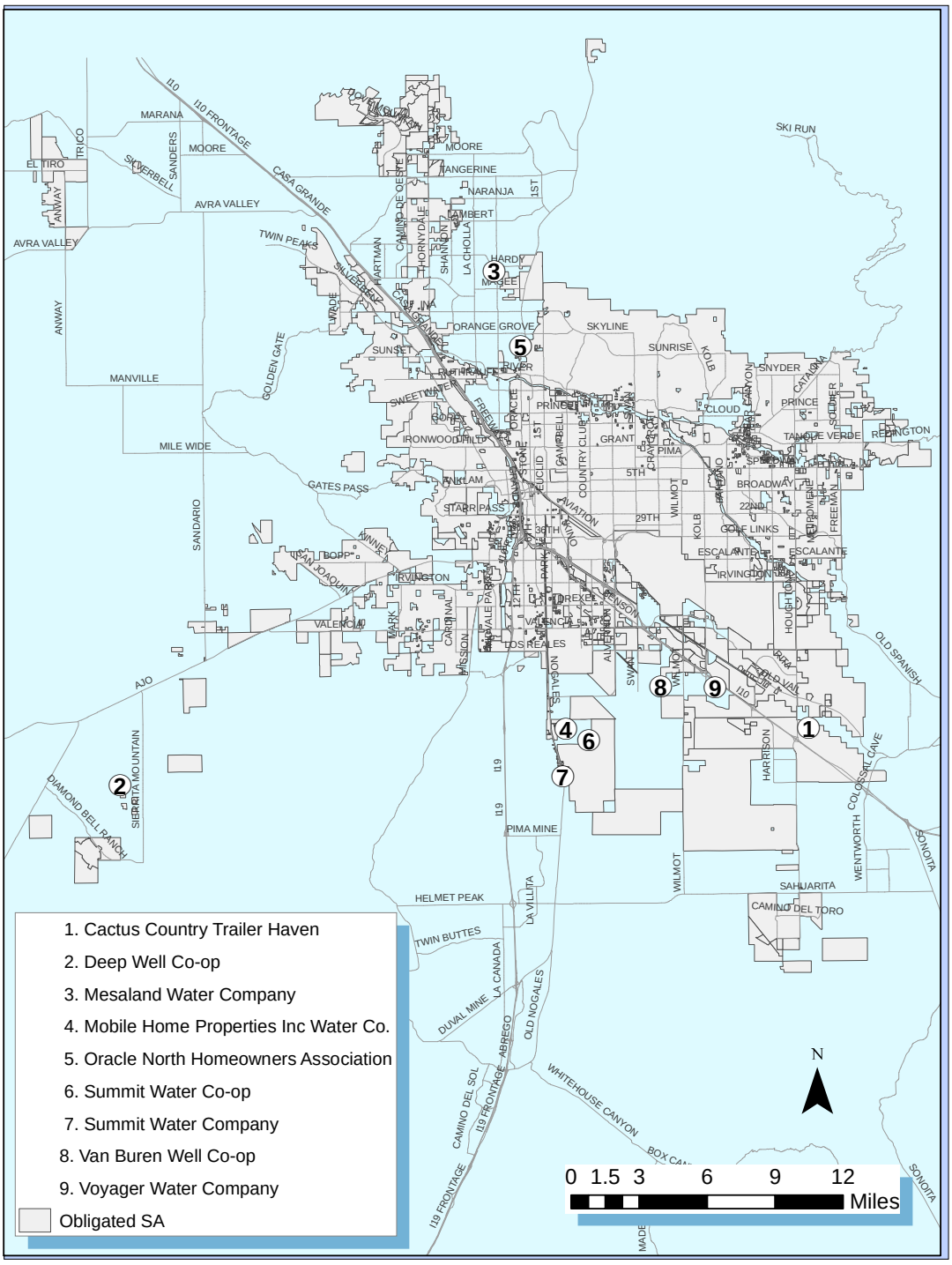

Figure A-6: Water providers with no drought plan and/or annual report within 1000 feet of Tucson Water's obligated service area (Source: ADWR, January 2009).